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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/689,177	10/20/2003	Juanita DeLoach	TI 35986	2711
23494	7590	12/10/2004	EXAMINER	
TEXAS INSTRUMENTS INCORPORATED P O BOX 655474, M/S 3999 DALLAS, TX 75265			GUERRERO, MARIA F	
			ART UNIT	PAPER NUMBER
			2822	

DATE MAILED: 12/10/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/689,177

Applicant(s)

DELOACH ET AL.

Examiner

Maria Guerrero

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 20 October 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

### **DETAILED ACTION**

1. This Office Action is the First Office Action on the merits.

#### **Status of Claims**

2. Claims 1-20 are pending.

#### **Specification**

3. The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

#### **Information Disclosure Statement**

4. The information disclosure statement (IDS) submitted on October 20, 2003 has been considered.

#### **Claim Rejections - 35 USC § 112**

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claim 20 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 20 recites the limitations "said transistors; said active region" in lines 1-3.

There is insufficient antecedent basis for this limitation in the claim.

***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims 1, 3 and 5-7 are rejected under 35 U.S.C. 102(b) as being anticipated by Tseng (U.S. 6,093,621).

7. Tseng discloses forming an opening in a substrate (100) through a patterned photoresist layer (106) and a hard-mask layer (silicon nitride) (104) located over the substrate with a plasma (Fig. 1A-1B, col. 2, lines 1-6, 38-55). Tseng teaches trimming the photoresist layer with a plasma to create an exposed portion of the hard-mask layer (Fig. 1C, col. 2, lines 1-10, col. 3, lines 1-5). Tseng shows removing the exposed portion with a plasma to create a trench guide opening and creating a trench through the trench guide opening with a plasma (Fig. 1D, col. 3, lines 5-20). Tseng teaches forming an oxide liner in the trench, depositing an oxide in the trench to form an isolation structure, and removing the hard-mask (Fig. 1E-1H, col. 3, lines 19-42).

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

8. Claims 2, 4 and 8-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tseng (U.S. 6,093,621) in view of Miller (U.S. 6,287,974).

9. Tseng discloses forming an opening in a substrate (100) through a patterned photoresist layer (106) and a hard-mask layer (silicon nitride) (104) located over the substrate with a plasma (Fig. 1A-1B, col. 2, lines 1-6, 38-55). Tseng teaches trimming the photoresist layer with a plasma to create an exposed portion of the hard-mask layer (Fig. 1C, col. 2, lines 1-10, col. 3, lines 1-5). Tseng shows removing the exposed portion with a plasma to create a trench guide opening and creating a trench through the trench guide opening with a plasma (Fig. 1D, col. 3, lines 5-20). Tseng teaches forming an

oxide liner in the trench, depositing an oxide in the trench to form an isolation structure, and removing the hard-mask (Fig. 1E-1H, col. 3, lines 19-42).

Tseng does not specifically show patterning the opening through a bottom anti-reflective coating (BARC) layer located between the photoresist and the hard-mask layer. Tseng does not specifically describe employing the same plasma tool, the source power, bias power, and flow rate as claimed. However, Miller teaches the bottom anti-reflective coating (BARC) layer may be disposed between the nitride layer and the photoresist layer to help the transfer of critical dimensions of the photoresist onto the nitride (col. 10, lines 54-60). Miller shows employing the same plasma tool (col. 4, lines 38-46, col. 6, lines 10-15, col. 8, lines 25-28). Miller discloses using gases including HBr, O<sub>2</sub>, and Ar, the flow rate from 0 sccm to 100 sccm, and the power within in the range (col. 8, lines 40-63, col. 9, lines 25-30).

In addition, the selection of the flow rate and power is considered to be obvious because it is not inventive to discover the optimum or workable ranges by routine experimentation. In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955). There is not evidence that the particular range is critical. In re Woodruff, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir.1990). See MPEP § 716.02 - § 716.02(g).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the Tseng reference by including the teachings of Miller i.e., the bottom anti-reflective coating (BARC) layer, the same plasma tool, in order to improve productivity (Miller, col. 2, lines 52-60).

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10. Claims 10-11, 13, 15-17 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tseng (U.S. 6,093,621) in view of Kadosh et al. (U.S. 5,770,483).

Tseng discloses forming an opening in a substrate (100) through a patterned photoresist layer (106) and a hard-mask layer (silicon nitride) (104) located over the substrate with a plasma (Fig. 1A-1B, col. 2, lines 1-6, 38-55). Tseng teaches trimming the photoresist layer with a plasma to create an exposed portion of the hard-mask layer (Fig. 1C, col. 2, lines 1-10, col. 3, lines 1-5). Tseng shows removing the exposed portion with a plasma to create a trench guide opening and creating a trench through the trench guide opening with a plasma (Fig. 1D, col. 3, lines 5-20). Tseng teaches forming an oxide liner in the trench, depositing an oxide in the trench to form an isolation structure, and removing the hard-mask (Fig. 1E-1H, col. 3, lines 19-42). Tseng teaches a pad oxide layer located between the substrate and the hard-mask layer.

Tseng does not specifically show forming transistors on the active regions and forming interconnects over the transistors to form an operative integrated circuit in the description of the preferred embodiments. However, Tseng discloses a method of forming an integrated circuit and more particularly a method of forming a shallow trench isolation structure (col. 1, lines 5-8). Tseng describes after fabricating the shallow trench isolation structure is conventional to form a transistor on an active region (col. 1, lines 23-42).

In addition, Kadosh et al. teaches forming trench isolation structures between active areas (Fig. 1, 3, 7, col. 4, lines 43-65). Kadosh et al. shows forming transistors on the active regions including forming wells and source and drain regions and forming

interconnects over the transistors to form an operative integrate circuit (Abstract, Fig. 7-9, col. 1, lines 22-32, col. 3, lines 4-15, col. 5, lines 1-10, col. 6, lines 5-50).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Tseng reference by including the interconnects over the transistors to complete the integrate circuit as suggested by Kadosh et al. in order to provide a multilevel transistor fabrication process having high performance interconnections and a shallow trench isolation without damaging the substrate (Kadosh et al., Abstract; Tseng, col. 1, lines 5-8, 65-67).

11. Claims 12, 14, 18-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tseng (U.S. 6,093,621) and Kadosh et al. (U.S. 5,770,483) as applied to claims 11, 13-17 above, and further in view of Miller (U.S. 6,287,974).

The combination of Tseng and Kadosh et al. does not specifically show patterning the opening through a bottom anti-reflective coating (BARC) layer located between the photoresist and the hard-mask layer. The combination of Tseng and Kadosh et al. does not specifically describe employing the same plasma tool, the source power, bias power, and flow rate as claimed. However, Miller teaches the bottom anti-reflective coating (BARC) layer may be disposed between the nitride layer and the photoresist layer to help the transfer of critical dimensions of the photoresist onto the nitride (col. 10, lines 54-60). Miller shows employing the same plasma tool (col. 4, lines 38-46, col. 6, lines 10-15, col. 8, lines 25-28). Miller discloses using gases including



HBr, O<sub>2</sub>, and Ar, the flow rate from 0 sccm to 100 sccm, and the power within in the range (col. 8, lines 40-63, col. 9, lines 25-30).

In addition, the selection of the flow rate and power is considered to be obvious because it is not inventive to discover the optimum or workable ranges by routine experimentation. In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955). There is not evidence that the particular range is critical. In re Woodruff, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir.1990). See MPEP § 716.02 - § 716.02(g).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Tseng and Kadosh et al. by including the teachings of Miller i.e., the bottom anti-reflective coating (BARC) layer, the same plasma tool, in order to improve productivity (Miller, col. 2, lines 52-60).

### ***Conclusion***

12. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Yen et al. (U.S. 6,261,921) teaches several steps related to applicant's disclosure.

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Maria Guerrero whose telephone number is 571-272-1837.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on 571-272-1852. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

December 6, 2004

*Maria Guerrero*  
**MARIA F. GUERRERO**  
**PRIMARY EXAMINER**